Syllabus MSNE 407-408 Fall 2019 – Spring 2020

rev. 24Aug2019 P.Loos

CAPSTONE DESIGN PROJECT - Students work in teams and use their knowledge and skills to solve a materials engineering problem. Each team will design and produce an engineered material, process, or device to meet a prescribed set of requirements and subject to various constraints. Students must complete MSNE 407 to receive credit for MSNE 408, and both must be taken the same academic year. Required for the BS degree in MSNE. Instructor's permission required. Pre-requisites: MSNE 303 or 304 and MSNE 311.

Instructor: Peter Loos ploos@rice.edu **Office:** MEB 215 **Office hours:** after class or by appointment.
Meets: 9:00-9:50 MWF in Ryon B08 or as assigned by the Registrar **Credits:** 4 in MSNE 407, 3 in MSNE 408

In this class there are no tests, no quizzes, no final exam, and no textbook; however, there will be several homework assignments. Many topics, tools, and ideas will be presented. Students must combine those with their knowledge of materials and engineering to design and produce a useful material, process, or device. In doing so students are expected to process some material and to characterize that material. To succeed in this class, students need to act at their own initiative, work hard, overcome obstacles, find their own resources, ask lots of questions, engage in effective teamwork, and be creative, objective, and analytical.

One or more projects will be scheduled for the duration of both semesters. These projects, which are the primary focus of the course, will be described in detail at the beginning of the fall semester. Students will be divided into teams of four to seven, and among the projects as much as possible according to their preferences.

A second focus of the course are ABET requirements, especially Criterion 3 Student Outcomes.

Consequently, a student's responsibilities in this course are divided into two areas:

1) **Classwork and homework on important topics in design, analysis, safety, and ethics:** instrument calibration, repeatability, reproducibility, rounding of measurement data, design of experiments, full and fractional factorial designs, linear models, interactions, significance, testing the null hypothesis, refining the model, using spreadsheet functions LINEST & NORMSINV, reliability testing, censored data, ethics, conflict of interest, avoiding any impropriety or appearance of impropriety, failing to warn the public, making fraudulent claims, materials safety, Safety Data Sheets, failure modes and effects analysis (FMEA), teamwork, Pugh decision matrix, fail often to succeed sooner (FOSS), etc. Classwork will occupy three or two hours per week in the fall semester, but only about one in the spring.
2) **The project work: team meetings, design, experimentation, analysis, and reporting** both verbally and in writing. Early in the year each student should be devoting an average of about 3 hours per week to the project, but toward the end of the year about nine hours/week.

Requirements and deliverables related to the project are summarized as follows:

- Weekly meetings of the project team with its advisor
- Individual student's project log books with bound and numbered pages. See "Recommended good practices for maintaining a lab notebook" at https://web.archive.org/web/20180621234912/http://ott.rice.edu/Content.aspx?id=194
- Team project binders containing all documentation (reports, presentations, digital files, and supporting materials)
- End-of-semester team presentations and written reports about the project
- A functioning prototype that has been tested against design criteria

Grading Policies: Semester grades are 60% individual effort and 40% team performance, as follows:

Team effort on the project	**Individual effort**
5% Project binder (including all documentation)	10% Project logbook = lab notebook (increases to 15% in Spring)
10% End of semester oral or poster presentation	20% Attendance & participation at lecture & team activities
5% Weekly progress reports	20% Contribution to team's design and achievement of goals
20% End of semester written report & design execution	10% Homework assignments (reduced to 5% in Spring)

The Instructor, each team's advisor, and the TAs will jointly determine grades. Any disputes over grading should be brought to Instructor and/or advisor in a timely manner. The following four grading rubrics will be provided to the students and used in grading of particular assignments: **Design Review, Lab Notebook Grading Rubric, End-of-Semester Reports,** and **Rubric for Final Oral Presentation.**

Homework: There will be about six homework assignments in the fall and about three in the spring.

Absence Policy: Attendance in class is required and will be factored into the course grade. Attendance at team meetings is equally important and also required. If absence is unavoidable, then students must notify other participants (Instructor, advisor, and/or team members) in advance, as soon as absence becomes likely.

Honor Code Policy: **For "pledged" assignments** students must do all the writing, calculating, and analyzing themselves, must **not** examine or copy from any work done by any other student (past or present), and must include and sign the Rice Honor Pledge on work turned in. **For all assignments** students are encouraged to talk to each other, the Instructor, project advisor, or anyone else with knowledge of the subject. Plagiarism and other academic fraud will be addressed per the Honor System Handbook.

References: When quoting or giving data or images from a source other than class lecture slides or article written by instructor, or one's own original work, a proper reference must be given. Use ACS format per pubs.acs.org/doi/pdf/10.1021/bk-2006-STYG.ch014 or in simpler form at: http://library.williams.edu/citing/styles/acs.php

Intellectual Property: Projects sponsored by organizations outside of Rice may be subject to a sponsored research agreement, in which case students and faculty participating in the projects must sign a sponsored project participation agreement covering – among other things – confidentiality of the sponsor's proprietary information, publication or public presentation of the team's results, patent application & ownership, and copyright registration.

Software: Students will use spreadsheets such as MS Excel or OpenOffice Calc, particularly their LINEST function, for some of the homework and project data analysis, as well as word processors such as MS Word or OpenOffice Writer for reports, and MS PowerPoint or OpenOffice Impress for presentations. For compatibility, all files should be saved in either XLS, DOC, PPT, or PDF format.

Goals for this course:

To address ABET Student Outcomes and Program Criteria, students will have the ability to:

1. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. communicate effectively with a range of audiences
4. recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

and the course will help prepare graduates

- to apply advanced science ... , computational techniques and engineering principles to materials systems ...
- to integrate the understanding of the scientific and engineering principles underlying the four major elements of the field: structure, properties, processing, and performance ...
- to apply and integrate knowledge from each of the above four elements of the field using experimental, computational, and statistical methods to solve materials problems including selection and design …

Resources:

OEDK Equipment: http://oedk.rice.edu/oedk-resources Tech Support: http://oedk.rice.edu/techsupport
Gary Cisneros cisneros@rice.edu MSNE Technician
Compendex/Inspec All fields of Engineering, physics, electronics, etc. Watch this MIT video (3:32).
PubChem free database providing physical, chemical, safety properties of a vast assortment of chemicals.
SciFinder The most comprehensive chemical information database, including articles, patents, conference papers, and theses. View Tutorials. Contact administrator for access.
Web of Science/ Web of Knowledge High impact journal articles in all fields.
Scopus Competitor to Web of Science. Includes all subjects and cited reference searching.
CRC Handbook of Chemistry & Physics Searchable data on thousands of materials' structure and properties
ASM Handbook for example: Vol. 3: Alloy Phase Diagrams, Vol. 13 Corrosion See Instructor for 9th ed. hard copies.
American Society for Testing and Materials: Annual Book of ASTM Standards In print (not online) at Fondren. Instructor has several volumes.

DoD & Federal Standards & Specifications from the Defense Logistics Agency. See especially Quick search
SAE Standards including Aerospace Materials Standards (AMS)
OneMine Full text papers from the Minerals, Metals & Materials Society (TMS), the American Institute of Mining, Metallurgical and Petroleum Engineers (AIME) and more.

Any student with a disability requiring accommodations in this class is encouraged to contact Instructor after class or during office hours. Also, students should contact the coordinator for Disabled Student Services.